

REMARKS

Applicants request favorable consideration and allowance of the above-identified application in view of the preceding amendments and the following remarks.

Claims 24-28 and 61-82 are presented for examination. Claims 24, 25 and 73 are in independent form. Claims 1-23 and 29-60 have been cancelled without prejudice to or disclaimer of the subject matter recited therein. Claims 24-28 have been amended to define more clearly what Applicants regard as their invention. Claims 61-82 have been added to provide Applicants with a more complete scope of protection. Support for these changes can be found in the original application as filed. Therefore, no new matter has been added.

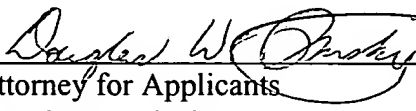
Newly added Claims 61-82 are believed to be directed to the invention of Group II, which was elected in Applicants' previous response.

Applicants filed Information Disclosure Statements in this application on June 25, 2001, October 31, 2001, and January 18, 2002. Applicants request that the Examiner return an initialed copy of each of the Forms PTO-1449 submitted with the Information Disclosure Statements, indicating that the art cited therein has been considered.

Applicants request early and favorable examination on the merits.

Applicants' undersigned attorney may be reached in our Washington, D.C. Office by telephone at (202) 530-1010. All correspondence should continue to be directed to our below listed address.

Respectfully submitted,


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APPENDIX

VERSION SHOWING CHANGES MADE TO CLAIMS

24. (Amended) A method for manufacturing a liquid discharge recording head provided with [the] a main body portion having liquid discharge ports, and pressure chambers with opening portions on parts thereof, being connected with [said] the liquid discharge ports, respectively, and piezoelectric vibrating portions installed to close [said] the opening portions, respectively, said method comprising the [following] steps of:

forming a vibrating plate and an electrode on a substrate;

forming on [said] the electrode a piezoelectric film containing (i) a first layer having a perovskite structure containing lead and titanium[, and setting a temperature of 500°C or more when forming on said first layer] and (ii) a second layer having a perovskite structure containing zirconium, lead, and titanium, the amount of zirconium contained in the first layer being one of zero and an amount less than the amount of zirconium contained in the second layer, by forming on the electrode the first layer, setting a temperature of at least 500°C and forming the second layer on the first layer at the set temperature, and then[, giving] providing quick cooling [from said] to reduce the temperature at least to 450°C with a cooling speed of at least 30°C/minute [or more for forming a piezoelectric film containing said first layer and second layer];

[separating said piezoelectric film] after the formation of [said] the

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piezoelectric film, dividing the piezoelectric film into portions corresponding to the pressure chambers;

forming [the] an upper electrode, and the pressure chambers corresponding [said separated] to the portions of the divided piezoelectric film[s]; and

bonding a nozzle plate having liquid discharge ports formed therefor[,
wherein in the step of forming said piezoelectric film, said first layer is formed so as not to contain zirconium or so as to make the amount of contained zirconium smaller than that of said second layer].

25. (Amended) A method for manufacturing a liquid discharge recording head provided with [the] a main body portion having liquid discharge ports, and pressure chambers with opening portions on parts thereof, being connected with [said] the liquid discharge ports, respectively, and piezoelectric vibrating portions installed to close [said] the opening portions, respectively, said method comprising the [following] steps of:

forming on a supporting substrate piezoelectric vibrating portions having a piezoelectric film containing (i) a first layer having a perovskite structure containing lead and titanium[, and setting a temperature of 500°C or more when forming on said first layer] and (ii) a second layer having a perovskite structure containing zirconium, lead, and titanium, the amount of zirconium contained in the first layer being one of zero and an amount less than the amount of zirconium contained in the second layer, by forming on the supporting substrate the first layer,

setting a temperature of at least 500°C and forming the second layer on the first layer at the set temperature, and then[, giving] providing quick cooling [from said] to reduce the temperature at least to 450°C with a cooling speed of 30°C/minute [or more for forming a piezoelectric film containing said first layer and second layer, and forming on said supporting substrate the piezoelectric vibrating portions having said piezoelectric film];

bonding without using an adhesive agent [the] a circumference of [said] each of the opening portions of [said] the main body portion with [the] a circumference of [said] each of the piezoelectric vibrating portions by arranging [them to be faced] the opening portions and the piezoelectric vibrating portions to face each other, respectively; and

removing [said] the supporting substrate subsequent to said bonding step[,

wherein in the step of forming said piezoelectric vibrating portion, said first layer is formed so as not to contain zirconium or so as to make the amount of contained zirconium smaller than that of said second layer].

26. (Amended) A method for manufacturing a liquid discharge recording head according to Claim [25, wherein said] 24, further comprising forming the first layer, second layer, vibrating plate, and electrode [are formed] by [the] a vapor method including sputtering and a CVD method.

27. (Amended) A method for manufacturing a liquid discharge recording

head according to Claim 24, wherein a silicon substrate is used as [said] the substrate, and in said step of forming the pressure chambers the substrate is partially removed by etching using a mixed acid of hydrochloric acid and nitric acid to form the [make the interior thereof] pressure chambers in the interior of the substrate.

28. (Amended) A method for manufacturing a liquid discharge recording head according to Claim 27, wherein in said step of forming the pressure chambers the substrate is partially removed by etching using hydrofluoric acid solution or potassium hydroxide solution.